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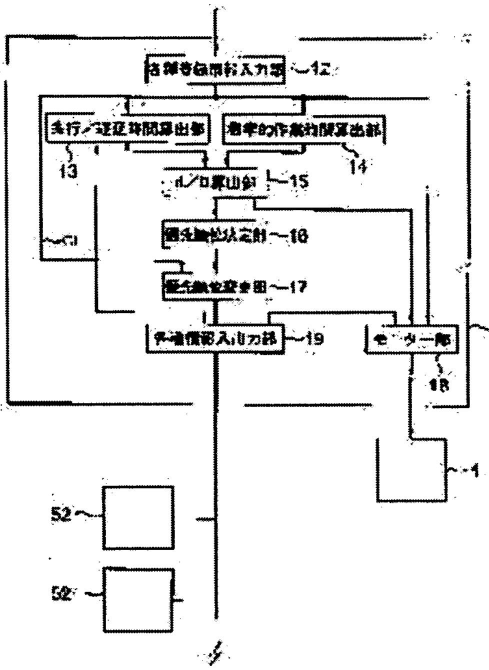
(54) METHOD AND DEVICE FOR MANAGING PRODUCTION IN COMPOUND MANUFACTURING PROCESS SYSTEM, AND METHOD OF MONITORING PRODUCTION PROGRESSING CONDITION

(57)Abstract:

PROBLEM TO BE SOLVED: To improve the adherence ratio of indicated date of delivery by changing priority order in each process on the basis of relative ahead/delay degree and the importance of each products in relation to the appointed concluding time.

SOLUTION: A computing unit 13 for computing ahead/delay time (d), a computing unit 14 for computing the standard working time D and a (d)/D computing unit 15 compute the relative ahead/delay degree (d)/D. A discrimination whether plural products compete with each other or not is done in each process. In the case where plural products compete with each other in the same process, priority order for specifying working order of the plural products is decided by a priority order deciding unit 16. After the priority order is decided, work is delayed from the working plan time of the process on the basis of a coefficient of importance previously given to each product competing with each other, and priority order of the products having high degree of importance regulated by the coefficient of importance is changed by a priority order changing unit 17.



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[Claim(s)]

[Claim 1] The production-control method characterized by providing the following of having two or more processes of doing predetermined work, and two or more manufacture processes constituted by the combination of each aforementioned process being compounded, and managing the work progress state of each product in the compound manufacture process system which can manufacture two or more sorts of products. The precedence to the work-plan stage planned beforehand or time delay (d) of each product in each aforementioned process The step which asks for the degree (d/D) of relative precedence / delay expressed with a ratio with the standard working hours (D) required by the time of completion of the aforementioned product from each aforementioned process. The step which determines the priority of the work of each aforementioned product in each aforementioned process based on the aforementioned degree (d/D) of relative precedence / delay. The step which changes the aforementioned priority in each aforementioned process based on the aforementioned degree (d/D) of relative precedence / delay, and the significance over the completion appointed stage of each product, and the step which directs the order of work in each aforementioned process of each aforementioned product according to the aforementioned priority.

[Claim 2] The precedence/time delay in the step which asks for the aforementioned degree (d/D) of relative precedence / delay is the production-control method in the compound manufacture process system according to claim 1 for which it asks based on the completion time information of work on each product in each process, the manufacture start time information on each aforementioned product, and the standard working-hours information in the manufacture process of each aforementioned product required for every process.

[Claim 3] The standard working hours (D) required by the time of completion from each aforementioned process in the step which asks for the aforementioned degree (d/D) of relative precedence / delay are the production-control methods in the compound manufacture process system according to claim 1 for which it asks based on the completion time information of work on each aforementioned product, and the standard working-hours information in the manufacture process of each aforementioned product required for every process.

[Claim 4] The step which determines the aforementioned priority is the production-control method in the compound manufacture process system according to claim 1 which determines the aforementioned priority according to the size of the aforementioned degree of relative precedence / delay when the product with which plurality differs in the same process competes.

[Claim 5] The step which changes the aforementioned priority is the production-control method in the compound manufacture process system according to claim 1 which applies the coefficient according to the size of the significance concerned to the degree (d/D) of relative precedence / delay of a product with a high significance over the aforementioned time of completion, and changes priority based on this result.

[Claim 6] The step which changes the aforementioned priority is the production-control method in the compound manufacture process system according to claim 1 which does not make a change which raises priority when there is no delay from the aforementioned work-plan time in the product concerned judging from the degree (d/D) of relative precedence / delay of a product with the aforementioned high significance.

[Claim 7] The production-control method in the compound manufacture process system according to claim 1 which processes each aforementioned step according to the changed work-plan time when the work-plan time when each product in each aforementioned process was planned beforehand is changed during manufacture of a product.

[Claim 8] The production progress state monitor method which is characterized by providing the following and which it has two or more processes of doing predetermined work, and two or more manufacture processes constituted by the combination of each aforementioned process are compounded, and acts as the monitor of the work progress state of each product in the compound manufacture process system which can manufacture two or more sorts of products. The precedence to the work-plan time planned beforehand or time delay (d) of each product in each aforementioned process The step which asks for the degree (d/D) of relative precedence / delay expressed with a ratio with the standard working hours (D) required by the time of completion of a product from each aforementioned process. The step which asks for the present degree of progress to the manufacture process of each aforementioned product. The step which graph-izes and is displayed on display so that the work progress status information which added the information on the aforementioned degree of relative precedence / delay to the degree of progress of each aforementioned product can be recognized visually.

[Claim 9] The production progress state monitor method in the compound manufacture process system according to claim 8 which adds the information on significance over the completion appointed time of the aforementioned product to the aforementioned work progress status information further, and is displayed on the aforementioned display.

[Claim 10] The step which displays the aforementioned work progress status information on display Display the time of a manufacture opening day on the X-axis, display the degree of progress of the aforementioned product on the Y-axis, and the manufacture start moon is displayed on the Z-axis. It responds to the manufacture opening day time second, the degree of progress, and the manufacture start moon of each aforementioned product. Above X Display a spherical display object on Y and Z-axis space, and the color, the brightness or color, and brightness which were changed to the aforementioned display object according to the degree of relative precedence / delay of each aforementioned product are added. The production progress state monitor method in the compound manufacture process system according to claim 9 which changes and displays the diameter of the aforementioned display object according to the significance over the completion appointed time of each aforementioned product.

[Claim 11] The production progress state monitor method in the compound manufacture process system according to claim 10 which displays the information on the product corresponding to the display object specified among the aforementioned display objects on the aforementioned display.

[Claim 12] The step which asks for the aforementioned degree of progress is the production progress state monitor method in the compound manufacture process system according to claim 8 for which it asks from the ratio of the standard working hours required by the present process of each aforementioned product, and the standard working hours which all the processes of the manufacture process of each product concerned take.

[Claim 13] The production progress state monitor method in the compound manufacture process system according to claim 8 which systematizes and gives a lot number, supplies to the aforementioned compound manufacture process system, extracts alternatively the aforementioned work progress status information about the product which has the lot number by which systematization was carried out [aforementioned], and displays it on the aforementioned display simultaneously so that it may associate the product lot-to-lot which relates to each aforementioned product mutually.

[Claim 14] Production-control equipment which is characterized by providing the following and which it has two or more processes of doing predetermined work, and two or more manufacture processes constituted by the combination of each aforementioned process are compounded, and manages the work progress state of each product in the compound manufacture process system which can manufacture two or more sorts of products. Precedence / a time delay calculation means to compute the precedence or time delay (d) over the work-plan time when each product was planned beforehand based on the completion information of work on each product in each process. A standard working-hours calculation means to compute the standard working hours (D) required by the time of completion of a product from each aforementioned process based on the completion information of work on each product in each process. A degree calculation means of relative precedence / delay to ask for the degree (d/D) of relative precedence / delay expressed with the ratio of the aforementioned precedence or a time delay (d), and standard working hours (D). A priority determination means to determine the priority of the work of each aforementioned product in each aforementioned process based on the aforementioned degree (d/D) of relative precedence / delay, and a priority change means to change the aforementioned priority in each aforementioned process based on the aforementioned degree (d/D) of relative precedence / delay, and the significance about the completion appointed time of each product.

[Claim 15] The production-control equipment in the compound manufacture process system according to claim 14 which it has in a monitor means asks for the degree of work progress for every lot of each product, gives the information on the aforementioned degree of relative precedence / delay to the degree of each aforementioned product of work progress based on the completion information of work on each aforementioned product, graph-izes so that the degree of progress of each aforementioned product and the degree of relative precedence / delay may recognize visually, and display to display.

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the production progress state monitor method which acts as the monitor of the production-control method of managing the work progress state of each product in each manufacture process and its equipment, and the work progress state in the compound manufacture process system by which two or more manufacture processes were compounded.

[0002]

[Description of the Prior Art] For example, in plants, such as a semiconductor device, where the product of many forms is intermingled using the same equipment and the same process, it is manufactured. That is, two or more manufacture processes constituted by the combination of two or more processes in the inside of the limited facility are compounded, and the compound manufacture process system which can manufacture two or more sorts of products is built. In such a compound manufacture process system, if nonuniformity is in the work progress state of two or more products, a lead time will vary for every product and expediting of a product will become difficult. Moreover, if an overall lead time is extended, the operating ratio of a facility will also fall. For this reason, in a compound manufacture process system, it is important to manage the work progress state of a product. Moreover, it is necessary from an economical viewpoint to give versatility and to perform two or more different manufacture processes at the same equipment and the same process for equipment or the process, and the production control corresponding to this is important.

[0003]

[Problem(s) to be Solved by the Invention] For example, in manufacturing the product of a kind with which A differs from B type in a manufacture process different, respectively in a compound manufacture process system, the case where a product which is different at the same process competes occurs. For example, in the compound manufacture process system which has the process of 1-10, the case where an A type product is manufactured in the manufacture process which flows the process of 1-10 in order, and it is manufactured in the manufacture process which a B type product flows the process of 4-7 again after flowing the process of 1-7 in order, and flows the process of 8-10 after that is assumed. In such a case, if two or more A and a B type product are fed into a compound manufacture process system at random, respectively, at each process of 1-10, competition of an A and B type product may occur.

[0004] In the former, when such competition occurred, before adopting the so-called FIFO which determines the work sequence of a product of competing according to the sequence supplied to the compound manufacture process system or feeding a product into a compound manufacture process system, work sequence was determined beforehand.

[0005] However, in FIFO, the standby time of the product which competes at each process becomes long, and disadvantageous profit that the lead time of a product will be extended as a result exists. Moreover, if the kind of product which is made intermingled and is manufactured increases, the number of processes of a manufacture process increases and a manufacture process is complicated, the production state in a compound manufacture process system is very difficult, and it is not practical to determine work sequence beforehand, before feeding a product into a compound manufacture process system, since it will be in a chaos state [**********].

[0006] On the other hand, if time for delivery may have to be shortened and it only pours the product of such a kind by the compound manufacture process system preferentially the case where the product which must observe the time of completion strictly certainly exists, and during manufacture in manufacturing two or more kinds of products by the compound manufacture process system, disadvantageous profit that the lead time of the product of other kinds will be extended sharply exists.

[0007] While this invention can be made in view of the problem mentioned above, can complete a product with high significance and urgency by the appointed time for delivery certainly in a compound manufacture process system and can raise the rate of observance to time for delivery The lead time of the whole product manufactured by the compound manufacture process system can be shortened. It aims at offering the production-control method in the compound manufacture process system which is made to increase the quantity of production and can grasp easily the work progress state in the manufacture process of each product, and the equipment and the production progress state monitor method.

[0008]

[Means for Solving the Problem] The production-control method of this invention has two or more processes of doing predetermined work, and two or more manufacture processes constituted by the combination of each aforementioned process are compounded. The precedence or time delay (d) over the work-plan stage when it is the production-control method of managing the work progress state of each product in the compound manufacture process system which can manufacture two or more sorts of products at, and each product in each aforementioned process was planned beforehand, The step which asks for the degree (d/D) of relative precedence / delay expressed with a ratio with the standard working hours (D) required by the time of completion of a product from each aforementioned process, The step which determines the priority of the work of each aforementioned product in each aforementioned process based on the aforementioned degree (d/D) of relative precedence / delay, Based on the aforementioned degree (d/D) of relative precedence / delay, and the significance over the completion appointed stage of each product, it has the step which changes the aforementioned priority in each aforementioned process, and the step which directs the order of work in each aforementioned process of each aforementioned product according to the aforementioned priority.

[0009] The precedence/time delay in the step which asks for the aforementioned degree (d/D) of relative precedence / delay are found based on the completion stage information of work on each product in each process, the manufacture start stage information on each aforementioned product, and the standard working-hours information in the manufacture process of each aforementioned product required for every process.

[0010] The standard working hours (D) required by the aforementioned time of completion from each aforementioned process in the step which asks for the aforementioned degree (d/D) of relative precedence / delay are found based on the completion stage information of work on each aforementioned product, and the standard working-hours information in the manufacture process of each aforementioned product required for every process.

[0011] The step which determines the aforementioned priority determines the aforementioned priority according to the size of the aforementioned degree of relative precedence / delay, when the product with which plurality differs in the same process competes.

[0012] The step which changes the aforementioned priority applies the coefficient according to the size of the significance concerned to the degree (d/D) of relative precedence / delay of a product with a high significance over the aforementioned time of completion, and changes priority based on this result.

[0013] The step which changes the aforementioned priority does not make a change which raises priority, when there is no delay from the aforementioned work-plan stage in the product concerned judging from the degree (d/D) of relative precedence / delay of a product with the aforementioned high significance.

[0014] When the work-plan stage when each product in each aforementioned process was planned beforehand is changed during manufacture of a product, each aforementioned step is processed according to the changed work-plan stage.

[0015] The production progress state monitor method of this invention has two or more processes of doing predetermined work. Two or more manufacture processes constituted by the combination of each aforementioned process are compounded. It is the production progress state monitor method which acts as the monitor of the work progress state of each product in the compound manufacture process system which can manufacture two or more sorts of products. The precedence or time delay (d) over the work-plan stage planned beforehand of each product in each aforementioned process, The step which asks for the degree (d/D) of relative precedence / delay expressed with a ratio with the standard working hours (D) to be required by the completion appointed stage of the product beforehand planned from each aforementioned process, It has the step which asks for the present degree of progress to the manufacture process of each aforementioned product, and the step which graph-izes and is displayed on display so that the work progress status information which added the information on the aforementioned degree of relative precedence / delay to the degree of progress of each aforementioned product can be recognized visually.

[0016] The information on significance over the completion appointed stage of the aforementioned product is further added to the aforementioned work progress status information, and it displays on the aforementioned display.

[0017] The step which displays the aforementioned work progress status information on display Display the time of a manufacture opening day on the X-axis, display the degree of progress of the aforementioned product on a Y-axis, and the manufacture start moon is displayed on the Z-axis. It responds to the manufacture opening day time second, the degree of progress, and the manufacture start moon of each aforementioned product. Above X A spherical display object is displayed on Y and Z-axis space, the color, the brightness or color, and brightness which were changed to the aforementioned display object according to the degree of relative precedence / delay of each aforementioned product are added, and the diameter of the aforementioned display object is changed and displayed according to the significance over the completion appointed stage of each aforementioned product.

[0018] The information on the product corresponding to the display object specified among the aforementioned display objects is displayed on the aforementioned display.

[0019] It asks for the step which asks for the aforementioned degree of progress from the ratio of the standard working hours required by the present process of each aforementioned product, and the standard working hours which all the processes of the manufacture process of each product concerned take.

[0020] A lot number is systematized and given and it supplies to the aforementioned compound manufacture process system, and the aforementioned work progress status information about the product which has the lot number by which systematization was carried out [aforementioned] is extracted alternatively, and is simultaneously displayed on the aforementioned display so that it may associate the product lot-to-lot which relates to each aforementioned product mutually.

[0021] The production-control equipment of this invention has two or more processes of doing predetermined work, and two or more manufacture processes constituted by the combination of each aforementioned process are compounded. It is production-control equipment which manages the work progress state of each product in the compound manufacture process system which can manufacture two or more sorts of products. Precedence / a time delay calculation means to compute the precedence or time delay (d) over the work-plan stage when each product was planned beforehand based on the completion information of work on each product in each process, A standard working-hours calculation means to compute the standard working hours (D) required by the time of completion of a product from each aforementioned process based on the completion information of work on each product in each process, A degree calculation means of relative precedence / delay to ask for the degree (d/D) of relative precedence / delay expressed with the ratio of the aforementioned precedence or a time delay (d), and standard working hours (D), A priority determination means to determine the priority of the work of each aforementioned product in each aforementioned process based on the aforementioned degree (d/D) of relative precedence / delay, The main management tool which includes a priority change means to change the aforementioned priority in each aforementioned process, based on the aforementioned degree (d/D) of relative precedence / delay, and the significance about the completion appointed stage of each product, It has a production control means to output the completion information of work on the product which was prepared in each process, and pointed to the work sequence in the process concerned based on the priority information outputted from the aforementioned main management tool, and work completed to the aforementioned main management tool.

[0022] Based on the completion information of work on each aforementioned product, it asks for the degree of work progress for every lot of each product, the information on the aforementioned degree of relative precedence / delay is given to the degree of work progress of each aforementioned product, and it has a monitor means graph-izes and display to display so that the degree of progress of each aforementioned product and the degree of relative precedence / delay can be recognized visually.

[0023] the priority of the work of a product in this invention -- fundamental -- the degree (d/D) of relative precedence / delay -- ****** -- priority becomes high, so that the time required by completion of a product is short if delay from the work plan of each product is the same since it is determined, and priority will be highly set up, so that delay from the work plan of a product is large, if the time required by completion of a product is the same Therefore, between each product, the nonuniformity of the degree of progress of work decreases and the whole lead time improves. On the other hand, since the priority in each process is changed based on the degree (d/D) of relative precedence / delay, and the significance about the completion appointed stage of each product, about a product with a high significance, the rate of observance of the completion appointed stage improves certainly.

[0024]

[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 is the block diagram showing the composition of the production-control equipment in the compound manufacture process system concerning 1 operation gestalt of this invention. The production-control equipment 1 concerning this operation gestalt has the terminal unit 52 installed in each process, respectively, and the main management equipment 3 connected by these terminal units 52 and communication wires. A personal computer can constitute the main management equipment 3 and a terminal unit 52. Display 4, the keyboard 5, and the mouse 6 are connected to the main management equipment 3, and display 53, the keyboard 54, and the mouse 55 are connected also to the terminal unit 52, and a display and I/O of various information are possible. Two or more manufacture processes constituted by the combination of two or more processes of doing predetermined work are compounded, and the production-control equipment 1 concerning this operation gestalt is applied to managing the work progress state of each product in the compound manufacture process system which can manufacture two or more sorts of products.

[0025] Drawing 2 is drawing showing the example of composition of the main management equipment 3. The main management equipment 3 has the various registration information input sections 12, the precedence / time delay calculation section 13, the standard working-hours calculation section 14, the d/D calculation section 15, the priority determination section 16, the priority change section 17, the monitor section 18, and the work progress information I/O section 19.

[0026] The various registration information input sections 12 are the weightings which show the significance over the standard working hours (TAT:Turn Around Time) which the manufacture process (line) name of the manufacture process for manufacturing the lot number given to the lot which consists of a product name of the product which should be manufactured from now on, and a single or multiple product, and the product concerned, each process name which constitutes a manufacture process, and a manufacture process take, manufacture start time, the completion appointed time, and the completion appointed time of a product. Moreover, the various registration information input sections 12 compute the work-plan stage in each process of each product based on the inputted various information. In addition, the work-plan stage in each process of each product is good also as composition which computes beforehand and is inputted into the various registration information input sections 12. Furthermore, if the changed completion appointed time is inputted when the completion appointed time of a product is changed during manufacture, the various registration information input sections 12 can go back the standard working hours TAT, and can newly compute the work-plan stage of each process.

[0027] The standard working hours TAT do the work to a product on standard conditions for every process, measure beforehand the time which this work takes, and input this information into the various registration information input sections 12. these standard working hours TAT sake [ask for every process and] and are standard -- based on working-hours TAT, the standard working hours TATela required by the time TATall which all the processes of a manufacture process take, and the present process, and the standard working hours D to be required by the time of product completion from the present process can be found, respectively

[0028] Precedence / time delay calculation section 13 computes the precedence or time delay d over the work-plan stage when each product was planned beforehand based on the completion information of work on each product in each process. The standard working-hours calculation section 14 computes the standard working hours D to be required by the completion appointed stage of the product beforehand planned from each aforementioned process based on the completion information of work on each product in each process. The d/D calculation section 15 calculates degree d/D of relative precedence / delay expressed with the ratio of precedence or a time delay d, and the standard working hours D.

[0029] Here, drawing 3 is drawing for explaining the calculation method of d/D in precedence / time delay calculation section 13, the above-mentioned standard working-hours calculation section 14, and the above-mentioned d/D calculation section 15. In drawing 3 , the work stage of each process is planned so that the product thrown into I at the time of a manufacture start may be completed at the completion appointed time O specified based on the above-mentioned standard working hours TAT. For example, if the completion plan stage of work of Process 1 (ERU) sets to t, suppose in fact that work was completed at the stage of t' according to a certain cause. Calculation of the precedence / time delay d over the work-plan stage when the product in this case was planned beforehand expresses precedence / time delay d with the following formula (1).

[0030]

d(l (ERU)) =t-t' -- (1)

[0031] Therefore, if precedence / time delay d (l (ERU)) takes the value of minus If work at Process l (ERU) is delayed for the plan and precedence / time delay d (l (ERU)) serves as zero Work at Process l (ERU) is done according to the plan, and when precedence / time delay d (l (ERU)) takes the value of plus, it turns out that work at Process l (ERU) precedes rather than the plan.

[0032] On the other hand, the standard working hours D required by product completion from the present process l (ERU) are computable from the standard working hours TAT which each above-mentioned process takes. the ratio of these standard working hours D, and the precedence/time delay d -- d/D is calculated a value with d/D small [d/D] -- ** -- the becoming product shows that the degree of progress of work is delayed relatively

[0033] The priority determination section 16 determines the priority of the work of each product in each process based on d/D. Specifically, priority of work is made high, so that the value of d/D is small.

[0034] For example, drawing 4 shows various information in case the product lot of a kind with which CX-001 differ [a lot number] from CX-002 competes at Process IV. As shown in drawing 4 , the manufacture process of the product lot of lot number CX-001 consists of process I-VI, and the manufacture process of the product lot of lot number CX-002 consists of processes I, III, IV, II, VI, V, and VII. The work-plan stage when the product lot of lot number CX-001 performs Process IV is on July 7, and is in the state which can start work on July 8 in fact. Therefore, precedence/delay period d is - one day. Moreover, work [in / Processes I II, and III / already] is completed to the product lot of lot number CX-001, and Processes IV, V, and VI are the work which is not yet being done. The standard working hours TAT required to perform these processes IV, V, and VI are one day, two days, and two days, respectively, and the standard working hours D required by completion of the product lot of lot number CX-001 from this are for five days. The value of d/D in the process IV of the product lot of lot number CX-001 is set to -0.2.

[0035] On the other hand, the work-plan stage when the product lot of lot number CX-002 performs Process IV is on July 4, and is in the state which can start work on July 8 in fact. Therefore, precedence/delay period d is - four days. Moreover, the work in Processes I and III is already completed to the product of lot number CX-002, and

Processes IV, II, VI, V, and VII are work which is not yet being done. The standard working hours TAT required to perform these processes IV, II, VI, V, and VII to the product lot of lot number CX-002 are four days, three days, two days, three days, and one day, respectively, and the standard working hours D required by completion of the product lot of lot number CX-002 from this are for 13 days. The value of d/D in the process IV of the product lot of lot number CX-002 is set to -0.3.08.

[0036] Since the value of d/D of the product lot of lot number CX-002 is small when the value of d/D of the product lot of lot number CX-001 and the product lot of lot number CX-002 is compared, priority of the work in the process IV of the product lot of lot number CX-002 is made high.

[0037] The priority change section 17 changes the aforementioned priority in each process based on the significance about d/D and the completion appointed stage of each product. Although the priority of the work in the same process is determined as the above-mentioned priority determination section 16, in a product, what should observe the completion appointed stage strictly is contained. Therefore, with this operation gestalt, the weightings Ci inputted through the various above-mentioned registration information input sections 12 are applied to the value of d/D. The input of weightings Ci can be beforehand inputted at the time of the manufacture start of a product, and can also be inputted during manufacture.

[0038] For example, in the example shown in drawing 4 , the priority of the work in the process IV of the product lot of lot number CX-002 was set up in the priority determination section 16 more highly than the product lot of lot number CX-001. However, 10 is inputted into the weightings Ci of the product lot of lot number CX-001 when the completion appointed stage of the product lot of lot number CX-001 is important. Consequently, the value of d/D of the product lot of lot number CX-001 is set to -2.0, and becomes smaller than the value of d/D of the product lot of lot number CX-002, and the priority of the product lot of lot number CX-001 goes up it. In addition, in competing at the process that many product lots are still the more nearly same, according to the significance, it sets up the weightings Ci to each product lot.

[0039] Moreover, in the priority change section 17, since weightings Ci are applied to the value of d/D of plus when significance is ahead of the product concerned to a work-plan stage judging from d/D of a high product (i.e., when the value of d/D is plus), priority becomes low further. However, since it is in the state where it is not delayed, it considers as priority [that weightings Ci are applied]. Since the value of d/D is subtracted only when the work progress state of a product is overdue from a work-plan stage and the time of completion of a product is not certainly delayed to the completion appointed stage, it is also possible to have a margin, to carry out the advance of the completion appointed stage, and to set it up beforehand.

[0040] The various information I/O sections 19 are outputted to the terminal unit 52 in which the priority information on the work of each product (product lot) from the priority change section 17 was prepared by each process while they always hold the work progress status information of each product. Moreover, the various information I/O sections 19 acquire the completion information of work on each product outputted from the terminal unit 52 formed in each process, and update the work progress status information of each product based on this information.

[0041] The monitor section 18 displays the work progress status information of each product mainly obtained from the various information I/O sections 19 on display 4. In addition, about concrete explanation of the method of presentation to the display 4 of the monitor section 18, it mentions later.

[0042] A terminal unit 52 outputs the completion information of work on the product which was prepared in each process, and pointed to the work sequence of the product in each process based on the priority information outputted from the main management equipment 3, and the progress status information of various products, and work completed to the aforementioned main management equipment 3. Specifically, the product (product lot) which works at the process concerned is displayed on the display 53 connected to the terminal unit 52 according to priority. Moreover, the information on the product (product lot) which work completed at the process concerned is inputted into a terminal unit 52 by a keyboard 54 and the mouse 55, and a terminal unit 52 outputs this completion information of work to the main management equipment 3.

[0043] Next, the example of the method of presentation to the display 4 of the monitor section 18 is explained based on the flow chart shown in drawing 5 . First, before carrying out the manufacture start of each product lot, a lot number is systematized and given and it supplies to a compound manufacture process system so that it may associate the product lot-to-lot related mutually. For example, when making a prototype and an actual product intermingled, manufacturing and you want to always supervise the work progress state of a prototype, it is. In such a case, in having given the lot number at random to the prototype lot and the actual product lot, it is difficult to extract quickly the work progress state of a prototype lot and an actual product lot. Therefore, even if it is in the state where the prototype lot and the actual product lot were intermingled to the compound manufacture process system, by giving the lot number of a system different, respectively to the prototype lot-to-lot related mutually and actual product lot-to-lot, it becomes possible to extract each work progress state quickly. Specifically, the lot number of the base of No. 100 is given to a prototype lot, and the work progress state of the product of the lot number of the base of No. 100 is extracted and it displays on display 4 simultaneously to give the lot number of the base of No. 1000 to an actual product lot, and see the work progress state of each prototype lot.

[0044] As shown in drawing 5 , in the monitor section 18, the work progress status information of the product of the specified lot number system is acquired (Step S51). Work progress status information is acquired from above-mentioned various information I/O sections 19 and various registration information input section 12 grades.

[0045] Subsequently, the degree PG of work progress of each product is calculated from the acquired work progress status information (Step S52). The degree PG of work progress is the above-mentioned standard operation time TATela which the process performed for each product till present takes. Standard working hours TATall which all the processes of the manufacture process of the product concerned take It asks as a ratio. Therefore, the degree PG of work progress can take the value of either 0-1.0.

[0046] Subsequently, d/D of each product computed in the d/D calculation section 15 is acquired (Step S53). Subsequently, the data for graph-izing the work progress state of each product based on the degree PG of work progress of each product lot and the value of d/D which were extracted, and the information on the moon thrown in with the part and the second at the day which fed each product into the compound process system, and the time are produced (Step S54).

[0047] Drawing 6 is an example which graph--ization-displayed the work progress state of each product on display 4. In the example of a display shown in drawing 6 , in the display screen 501, the time of a manufacture opening day is displayed on the X-axis, the degree PG of work progress is displayed on a Y-axis, the manufacture start moon is displayed on the Z-axis, and the spherical display object S is plotted to Above X and Y and Z-axis space according to the degree PG of work progress, and the manufacture start moon at the time of the manufacture opening day of each product lot. Moreover, the color and brightness according to the size of a value of d/D are added to each display object S. While making it change in order of green, yellow, and red as the value of d/D of the increase also of the brightness of the display object S and each product lot becomes small, while specifically changing the color of the display object S in order of green, blue, and a white as the value of d/D of each product lot becomes large, the brightness of the display object S is also made to increase. Furthermore, the path of the display object S is changed in proportion to the size of the weightings Ci which each product described above.

[0048] While the degree of work progress of each product lot can grasp by glance from the height of Y shaft orientations by taking the above display technique, the relative degree of precedence/delay can be easily grasped by seeing the color of the display object S corresponding to each product lot. Moreover, since the diameter is relatively large, the display object S of a product lot with a high significance can be discriminated easily, and a product lot with a high significance can prevent becoming time-for-delivery delay accidentally certainly by seeing the color of the display object S of a product lot with this high significance.

[0049] Moreover, pointer PT displayed on display 4 to see the various information on the product lot corresponding to the display object S For example, it is also possible to consider as the composition in which the data display section 502 is displayed on the display screen 501 by moving to the display object S which corresponds by operation of a mouse 6, and specifying this display object S (click). The significance of the specified product lot, a product name, a lot number, the completion appointed day, a completion anticipation day, a production-line name (manufacture process name), the present process name, notes, etc. are displayed on the data display section 502, for example.

[0050] In addition, although are considered as the composition to which both the color of the display object S and brightness are changed with this operation gestalt, and only either is good, the relative degree of precedence/delay can be grasped still more easily by changing both a color and brightness. Moreover, although the part and the second were displayed and the manufacture start moon was expressed to the X-axis as this operation gestalt in the display screen 501 shown in drawing 6 at the Z-axis at a manufacture opening day and the time the lead time of the product to manufacture -- the X-axis -- the time -- a part -- It can consider as the combination which displays a second on the combination which displays a year on the Z-axis at the moon, a day, and the time, and the X-axis at the combination which displays a day on a second and the Z-axis, and the X-axis, and displays a part on the Z-axis, and can change suitably according to the lead time of the product to manufacture. Moreover, although considered as the composition which displays the work progress state of each product lot on the display 4 of the main management equipment 3 with this operation gestalt, this invention is not limited to this, but can be displayed on the display 53 of not only the main management equipment 3 side but each terminal unit 52, and the various operations from a terminal unit 52 are possible for it.

[0051] Next, an example of the production-control method using the production-control equipment 1 of the above-mentioned composition is explained based on the flow chart shown in drawing 7 . First, various registration information is inputted into the main management equipment 3 (Step S1). Various registration information is the weightings Ci which show the significance over the standard working hours TAT which each process of the product name of the product which should be manufactured, a lot number, a manufacture process (line) name, each process name that constitutes a manufacture process, and a manufacture process takes, manufacture start time, the completion appointed time, and the completion appointed time of a product. In addition, although the various registration information on each product was considered as the composition inputted into the main management equipment 3 with this operation gestalt, the input from the terminal unit 52 formed in each process is also possible. The input of various registration information is enabled only after the input of the password which corrected, for example, was beforehand registered from the terminal unit 52 is carried out (correction is possible), and according to a password, the range (correction is possible) which can be inputted is restricted according to a person in charge. It is necessary to restrict especially the number of input persons in charge of the completion appointed time. Moreover, the number of the products which set up significance highly with weightings Ci is restricted to some extent so that the whole order may not be disturbed greatly.

[0052] Subsequently, d/D of all products is computed (Step S2). Calculation of d/D is performed by precedence / above-mentioned time delay calculation section 13 and the above-mentioned standard working-hours calculation section 14, and the d/D calculation section 15.

[0053] Subsequently, in each process, it judges whether two or more products are competing (Step S3). Since this judgment can detect the process at which each product should progress to a degree from the various registration information on each product, and the completion information of work on each product inputted from each terminal unit 52 formed in each process, it can judge whether two or more products progress to the same process simultaneously from this.

[0054] Subsequently, in the same process, when two or more products compete, the priority which specifies from which product work is done among two or more products is determined (step S4). Determination of priority changes the priority of a product with a high significance which work is late from the work-plan stage of the process concerned, and is specified with weightings Ci based on the weightings Ci beforehand given to each product which competes (Step S5).

[0055] The product information to which ****** should do ** and work on the priority finally determined is directed in the display 53 of each terminal unit 52 formed in each process (Step S6). At each process, see the display state of display 53 and predetermined work is done on a corresponding product, or each operator works the equipment formed in each process, and performs predetermined work to a product, for example.

[0056] In each process, if the predetermined work to a product is completed, an operator will input into a terminal unit 52 the information which the work of the product concerned completed, for example (Step S7). Priority performs same processing about a low product (Step S8). In addition, automation is also possible although considered as the composition whose operator (operator) performs processing of Step S6 and Step S7 with this operation gestalt.

[0057] It is in the middle of manufacture, and is to change a modification, for example, the completion appointed time of each product registered into the main management equipment 3. In such a case, if the completion appointed time of the changed product is inputted, the various registration information input sections 12 of the main management equipment 3 will go back the completion appointed time changed by the standard working hours TAT, and will newly compute the work-plan stage of each process. Each above-mentioned processing is performed based on this changed work-plan stage, and it is ****. That is, d/D is computed based on the changed work-plan stage, priority is determined and the product with which the completion appointed time was brought forward is changed in the middle of manufacture.

[0058] Next, the result which carried out the simulation of the production-control method concerning this above-mentioned operation gestalt is explained. As software, it is the simulation software of for example, the product made from Systems Modeling Corp. The simulation was performed using ARENA Version2.01. The compound process system which consists of a manufacture process for manufacturing a four A-D type product as conditions for a simulation was defined, and as shown in drawing 8 , the combination of the process of 10 of a process 1 - a process 10 constituted each manufacture process for a A-D type. Moreover, the processing time which each process of a process 1 - a process 10 takes, and the conveyance time between processes were defined as shown in drawing 9 .

[0059] Furthermore, the production ratio of a four A-D type product was defined as 40, 30, and 20 or 10%, respectively, and each product was thrown in at random. Moreover, the total simulation period was set to 11520min, excepted 1440 minutes from the total as an initial state, and made the observation period 10080 minutes. Moreover, although the injection interval of each product was made into 66, 60, 58, 57, and 55 minutes, the load factor of the process 7 which requires the processing time most becomes 100%, and the result of the sum total performed 10 times about the case where it is 55 minutes which is the case where a product collects in front of a process 7 is shown. All the significance over the completion appointed stage of (1) each product followed the case where it considers as an equal, the case where significance over the completion appointed stage of a (2) D type product is made higher than the product of other types, and the production-control method by FIFO of (3) former, among the production-control methods which a simulation requires for this invention.

[0060] Drawing 10 is as a result of [which was performed under the above-mentioned conditions / in the above (1)] a simulation, drawing 11 is as a result of [in the above (2)] a simulation, and drawing 12 is as a result of [of the production-control method by FIFO] a simulation. The horizontal axis of drawing 10 - drawing 13 shows the lead time from an injection of each product (product lot) to completion, and the vertical axis shows the number of products, and the scale of a vertical axis is increased 10 times to drawing 13 about drawing 10 and drawing 11 . Although a peak is in the number of products of the lead time for about 1300 minutes and 1850 minutes in the simulation result of FIFO of (3) shown in drawing 12 By the method of (1) of this invention of drawing 10 , the peak of the number of products completed by the lead time for about 500 minutes exists. by the method of (2) of this invention of drawing 11 It turns out that the peak of the number of products completed by the lead time for about 900 minutes exists, and the lead time of the whole FIFO ratio **** of (3) is shortened when it is (1) of this invention, and any of (2). Moreover, to average lead times being about 689 minutes and about 819 minutes in (1) of this invention, and (2), respectively, by FIFO of (3), it is about 3232 minutes and, in any [of (1) of this invention, and (2)] case, the average lead time is sharply shortened compared with the former. In the ten sum totals, although the transaction-data number of cases is also 897 affairs, it is known by increasing to 1736 affairs and 1670 affairs, respectively with the method of (1) and (2) at FIFO of (3).

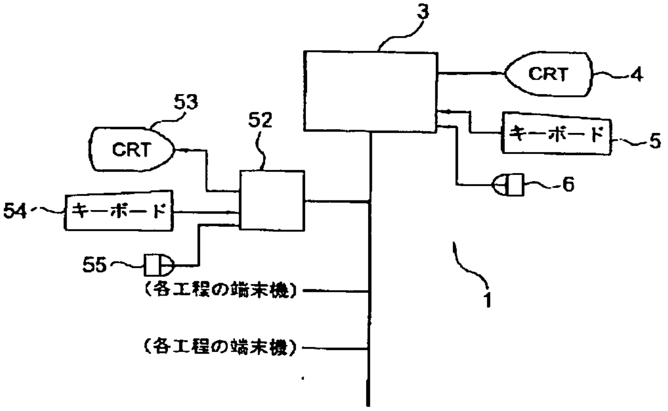
[0061] Drawing 13 - drawing 16 are the distribution maps showing the relation between the lead time of the product according to each type obtained in the simulation by the all directions formula of above-mentioned (1) - (3), and the number of generation rates of product completion, and, for drawing 13 , A type and drawing 14 are [C type and drawing 16 of B type and drawing 15] D type cases. drawing 13 - drawing 16 show -- as -- the product according to each type -- the way of (1) of this invention, and the method of (2) -- the FIFO ratio **** of (3) -- the number of generation rates of the product completion by the short lead time is high Moreover, a peak is looked at by the number of generation rates of a D type product, when significance over the completion appointed stage of the D type product of the method of (2) is made higher than the product of other types, as shown in drawing 16 .

[0062] Although it turns out by the method of (2) that the lead time of a product A-C type [other] is influenced from drawing 13 - drawing 15 since the significance of a D type product was set up highly when the method of (1) of this invention is compared with the method of (2), this influence is suppressed to the minimum and, as for the method of (2), the whole lead time is shortened by the FIFO ratio **** large width of face of (3). That is, in FIFO of (3), if a product with an only high significance is poured preferentially, although the standby time of other products will be extended and the lead time of all products will be extended as a result, there is little influence which it has on the lead time of other products in it in order that the method of (2) of this invention may go up [priority], only when the product with a high significance is late from the planned work stage. Moreover, by the method of this invention, although priority can be changed at each process based on d/D, it is necessary to set up priority beforehand and priority of work cannot be appropriately changed in FIFO of (3) etc. according to the work progress state of a product.

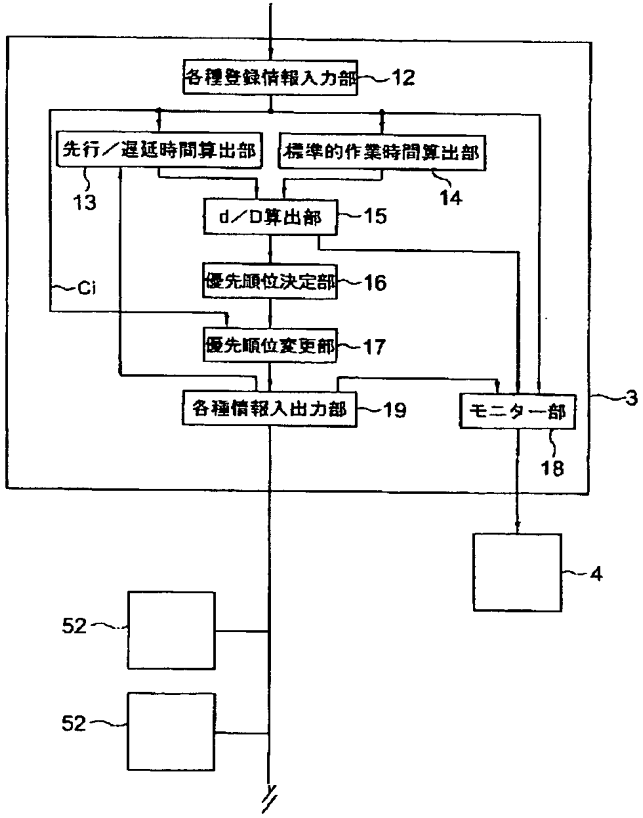
[0063]

[Effect of the Invention] While according to this invention being able to complete a product with high significance and urgency by the appointed time for delivery certainly in a compound manufacture process system and being able to raise the rate of observance of the appointed time for delivery, the lead time of the whole product manufactured by the compound manufacture process system can be shortened, and the quantity of production in a compound manufacture process system can be made to increase. Moreover, according to this invention, while being able to grasp easily the work progress state in the manufacture process of each product, according to the work progress state of a product, the priority of work can be changed appropriately.

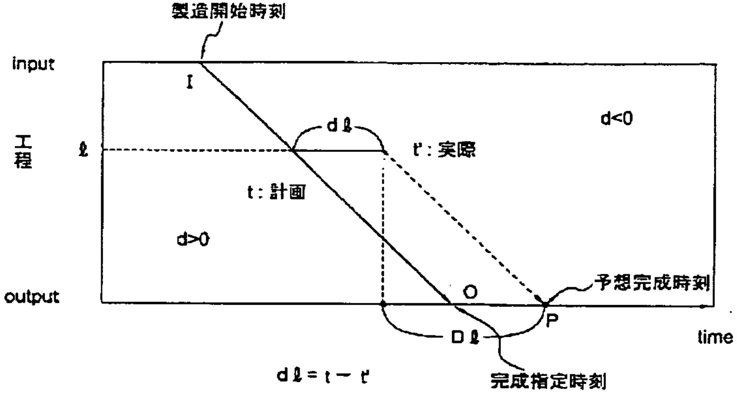
[Drawing 1]



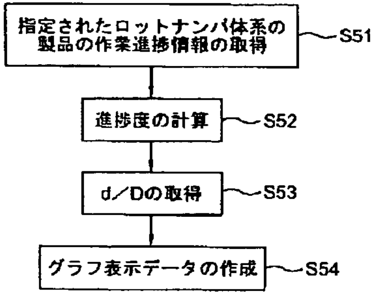
[Drawing 2]



[Drawing 3]



[Drawing 5]



[Drawing 4]

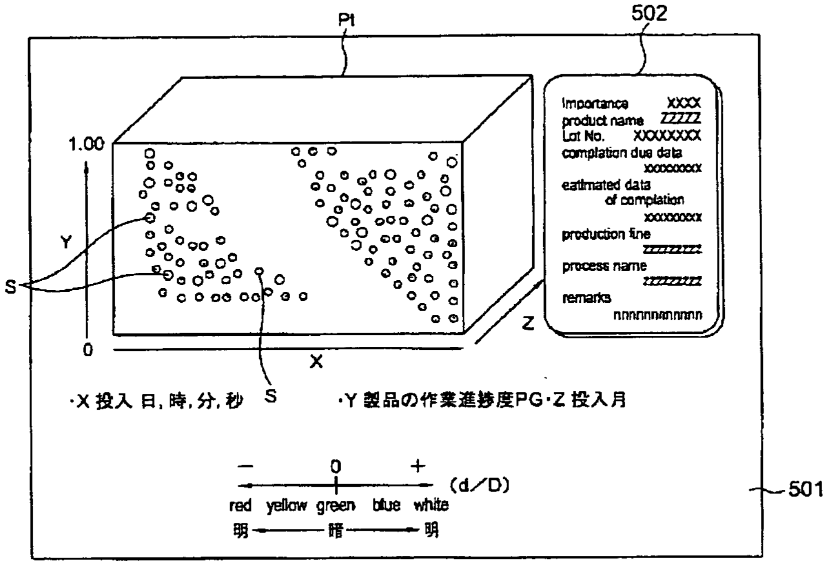
CX-001

Process	TAT	Plan	Actual/Estimated	d	D	d/D	Priority
			7/3				
I	1	7/2	7/3	-1	10	-0.100	
II	2	7/3	7/5	-2	9	-0.222	
III	2	7/5	7/7	-2	7	-0.286	
IV	1	7/7	7/8	-1	5	-0.200	2
V	2	7/8	7/10	-2	4	-0.500	
VI	2	7/10	7/12	-2	2	-1.000	
		finish 7/12					

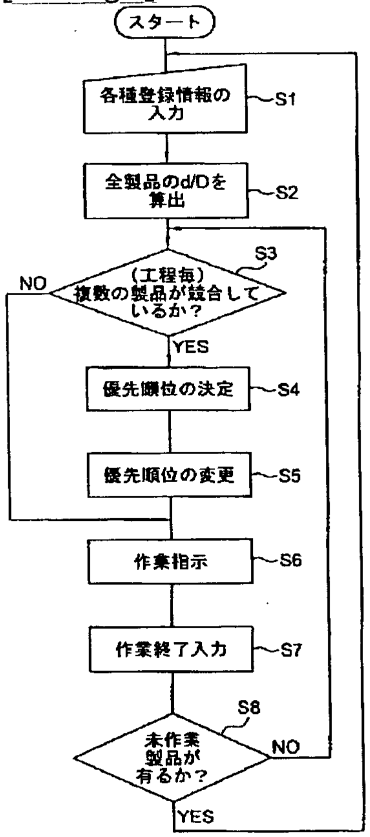
CX-002

Process	TAT	Plan	Actual/Estimated	d	D	d/D	Priority
			7/1				
I	2	6/29	7/1	-2	18	-0.118	
III	3	7/1	7/4	-3	16	-0.188	
IV	4	7/4	7/8	-4	13	-0.308	1
II	3	7/8	7/11	-3	9	-0.333	
VI	2	7/11	7/13	-2	6	-0.333	
V	3	7/13	7/16	-3	4	-0.750	
VII	1	7/16	7/17	-1	1	-1.000	
		finish 7/17					

[Drawing 6]



[Drawing 7]



[Drawing 8]

製造プロセス

Aタイプ： 工程1→工程2→工程3→工程4→工程5→工程6→工程7→
工程8→工程9→工程10

標準的作業時間：161.00［min］

Bタイプ： 工程1→工程2→工程3→工程4→工程5→工程6→工程7→
工程4→工程5→工程6→工程7→工程8→工程9→工程10

標準的作業時間：256.40［min］

Cタイプ： 工程1→工程2→工程3→工程4→工程5→工程6→工程7→
工程4→工程5→工程6→工程7→工程4→工程5→工程6→
工程7→工程8→工程9→工程10

標準的作業時間：351.80［min］

Dタイプ： 工程1→工程2→工程3→工程4→工程5→工程6→工程7→
工程4→工程5→工程6→工程7→工程4→工程5→工程6→
工程7→工程4→工程5→工程6→工程7→工程8→工程9→
工程10

標準的作業時間：447.20［min］

[Drawing 9]

搬送時間と各工程の処理時間[min]

搬送時間 — 工程1 — 搬送時間 — 工程2 — 搬送時間
0.05 10.00 0.10 15.00 0.10

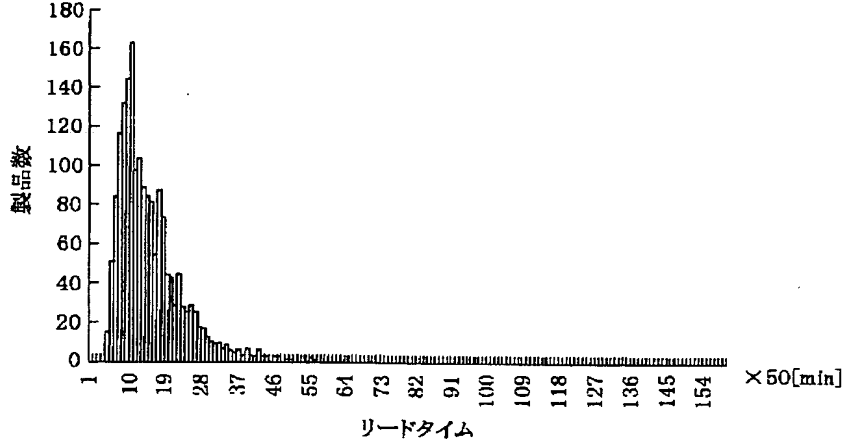
工程3 — 搬送時間 — 工程4 — 搬送時間 — 工程5
10.00 0.10 20.00 0.10 25.00

搬送時間 - 工程6 — 搬送時間 -- 工程7 — 搬送時間
0.10 20.00 0.10 30.00 0.10

工程8 — 搬送時間 — 工程9 — 搬送時間 — 工程10
5.00 0.10 10.00 0.10 15.00

搬送時間
0.05

[Drawing 10]



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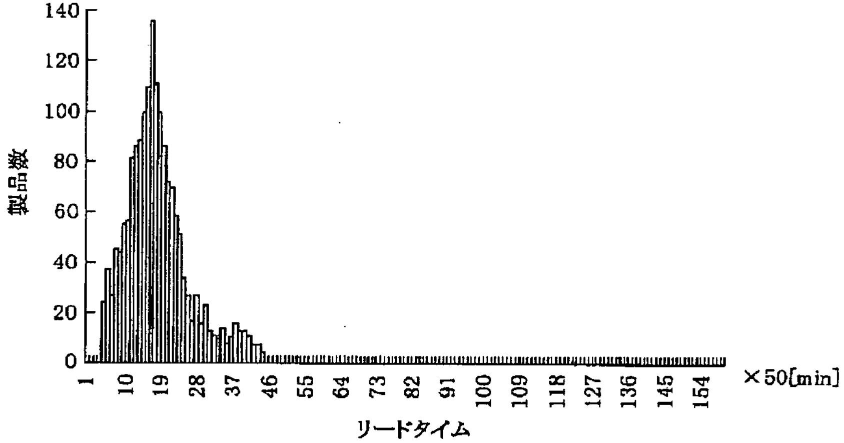
[Drawing 11]



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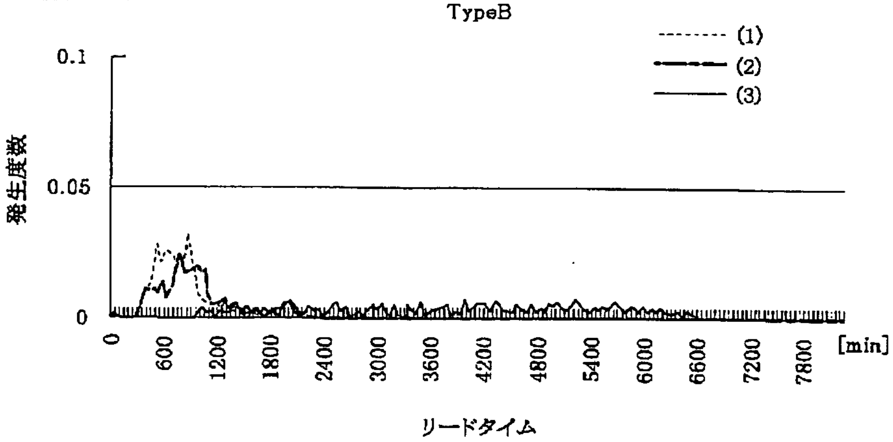
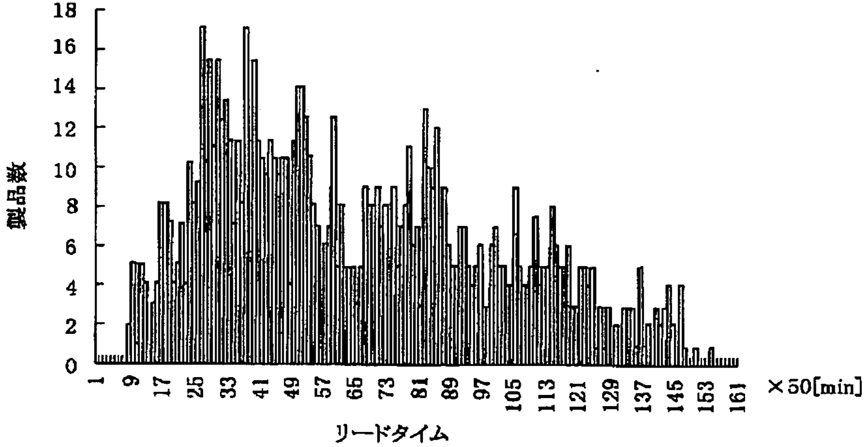
[Drawing 14]

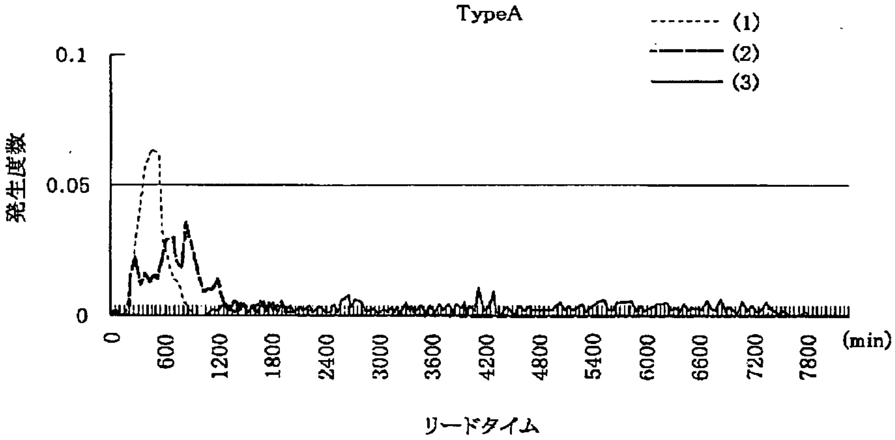


[Drawing 12]

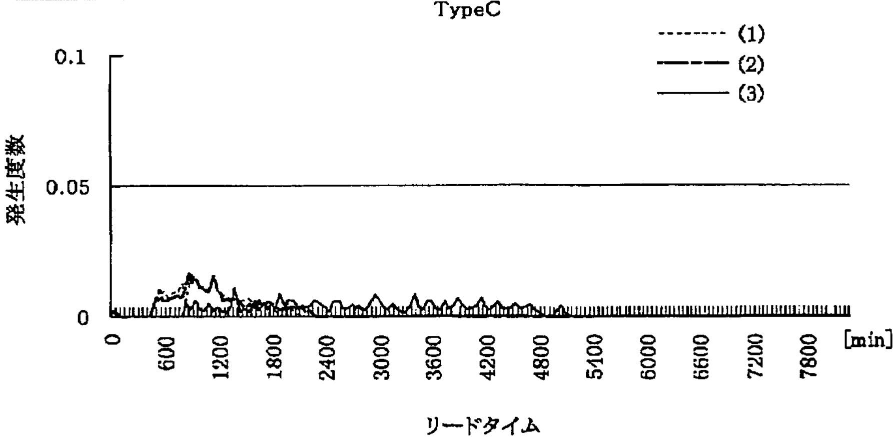


平均リードタイム　3232.50262 [min]
最頻値　1566.45 [min]
標準偏差　1724.279382 [min]
発生データ件数　897件（10回分）

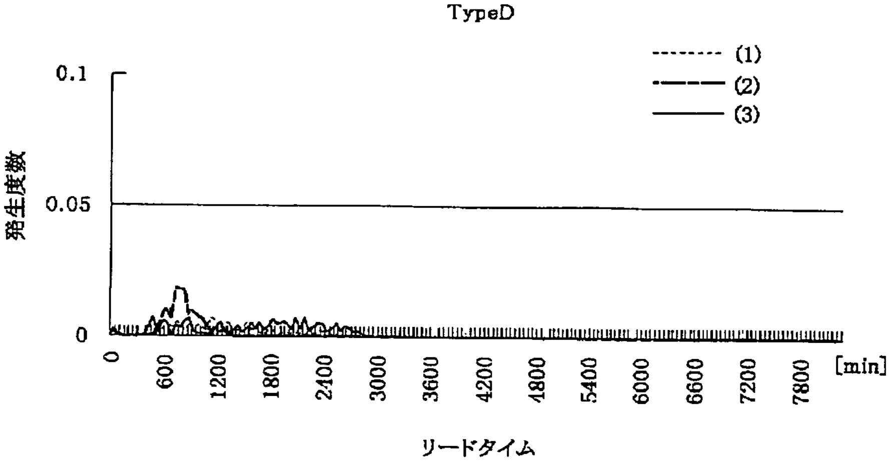
[Drawing 13]



[Drawing 15]



[Drawing 16]


TypeD
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(2)
(3)
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6600
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リードタイム